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A Conceptual Framework for Understanding Latent Demand: Accounting for Unrealized Activities and Travel

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Portland State
UNIVERSITY

CONCEPTUAL FRAMEWORK FOR UNDERSTANDING LATENT DEMAND

Accounting for Unrealized
Activities & Travel

Kelly J. Clifton

Intro



“Build it and they will come” argues that there is a “pent up” demand that will be activated by transportation improvements.

Most studies of latent & induced demand focus on traveler responses to changes in travel costs.

There has been little discussion of the underlying behavioral foundations of latent demand

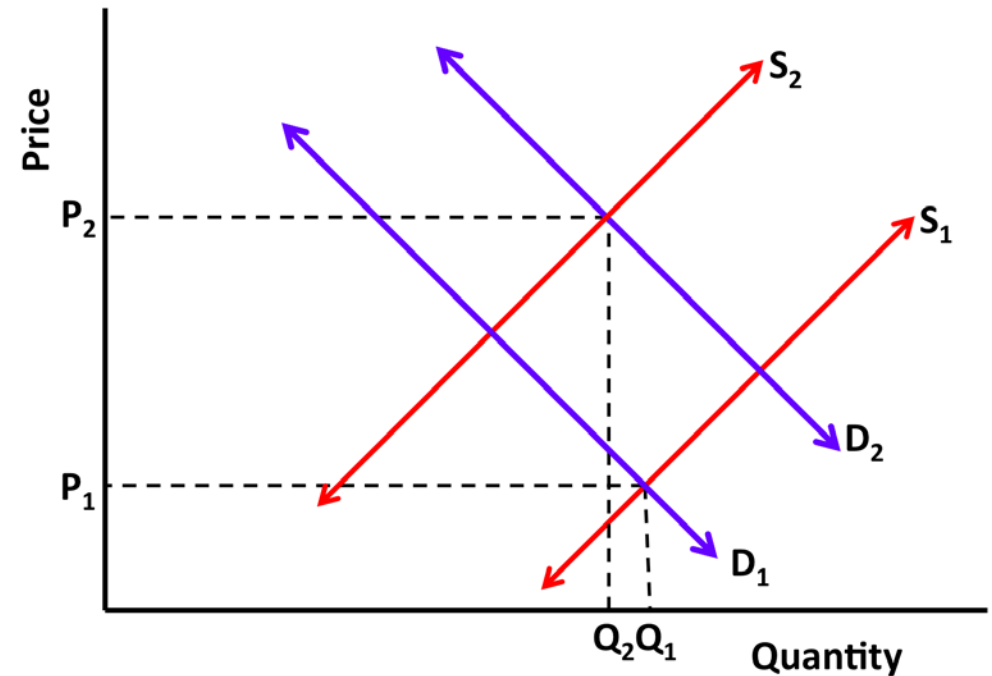
A better definition of latent demand can aid in better forecasting, understand the consequences of unrealized travel, and identify where unmet demand is central to transportation policy.

Demand for transportation

Transport demand is about the movement of people and goods.

It is considered a ***derived demand***, which refers to demand for one good or service in one sector occurring as a result of demand from another.

Users of transport are primarily consuming the service because they wish to satisfy their needs (e.g. work, shopping, recreation) – or in the case of freight, the demand for goods.



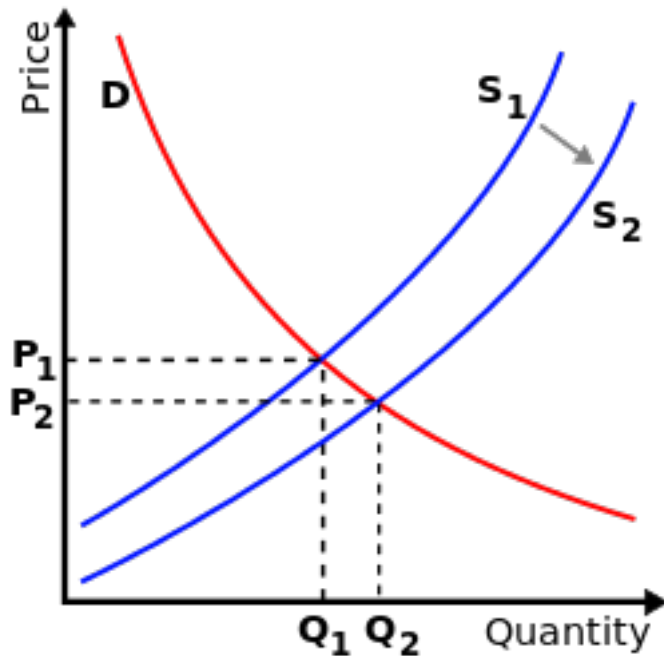
Latent (or Induced) Demand for Travel

Latent demand represents **currently desired demand** that is not realized because of a wide variety of constraints.

Redistributed demand represents a **rearrangement** in space, time, destination, frequency and/or mode of the previously observed demand due to the relative changes in travel costs.

This represents our current approach to forecasting future travel needs – evaluating current demand based upon future predictions of the various explanatory factors.

Generative demand, are previously **suppressed trips** that can now be realized, presumably due to changes in the transportation system but perhaps due to exogenous social, economic, cultural and technological drivers.



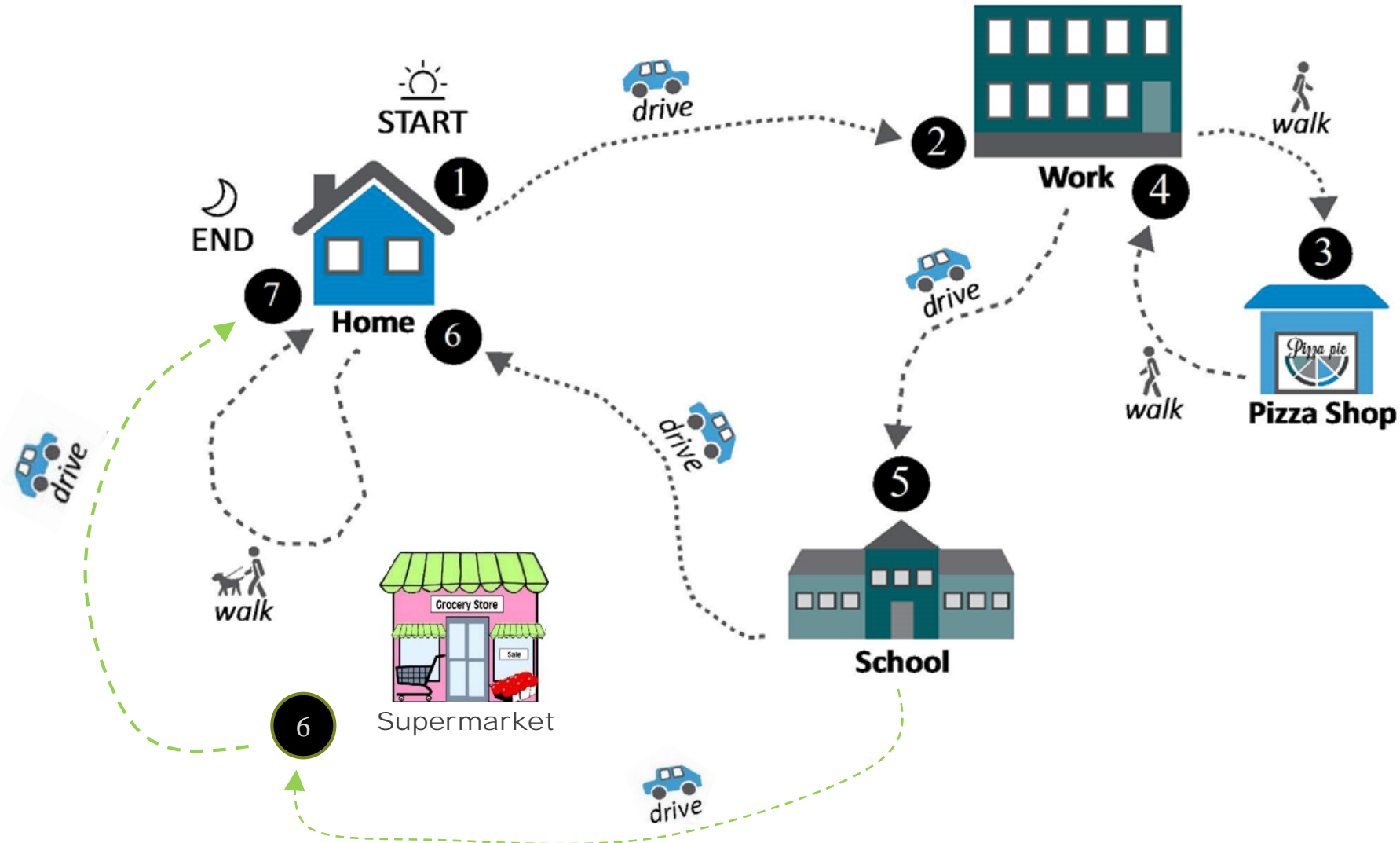
Demand models
are estimated
using data on
observed trips

What about
unmade trips?

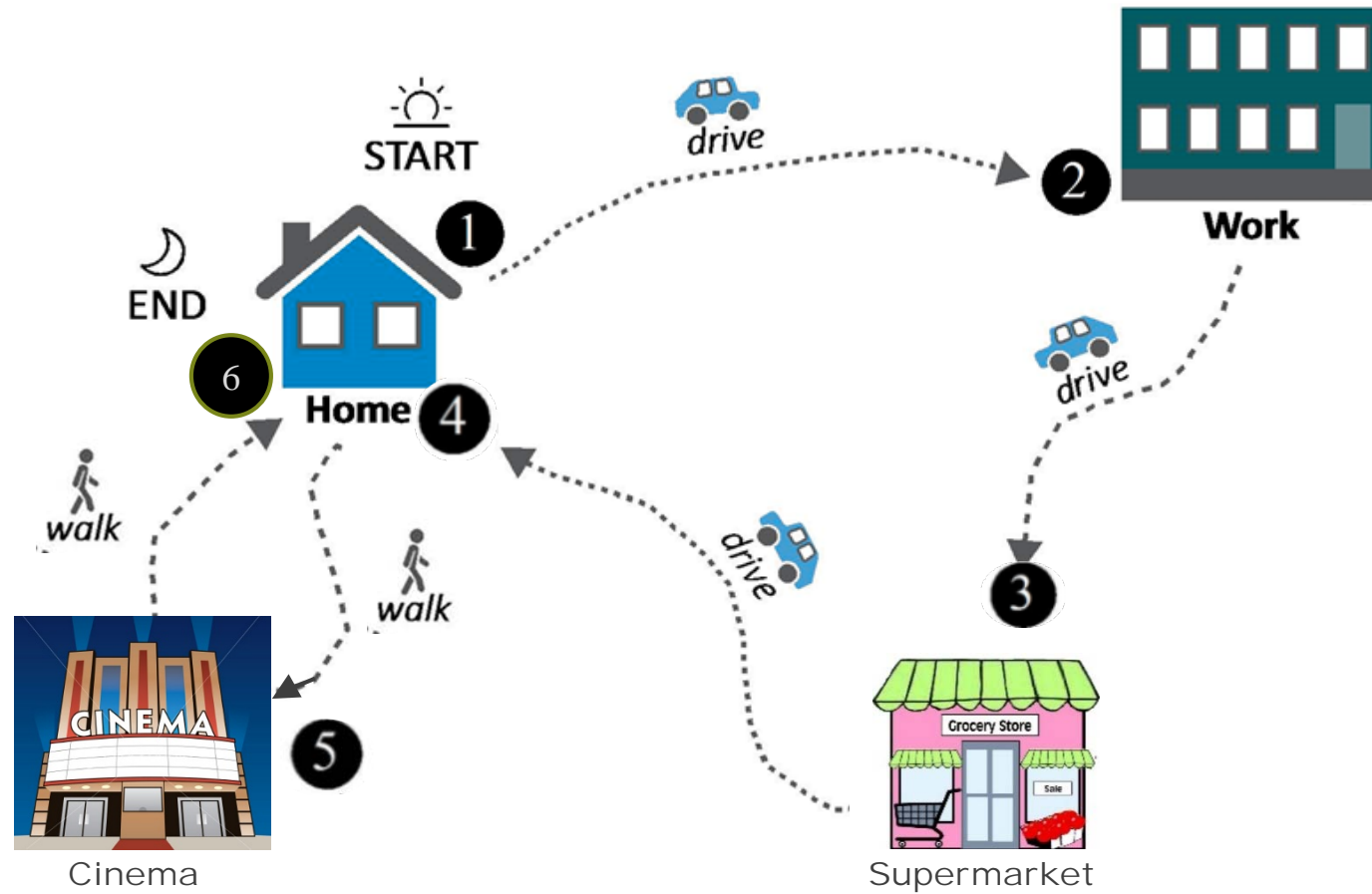
1 Where did you go?	2 How did you get there?			3 What did you do?	
START HERE Place 1: Where were you at 4:00 AM on your assigned travel day? Provide place name and address/intersection: <i>Home</i>	What time did you arrive at this place?	How did you get to this place? (for example, walk, car, bus, train, etc.)	How many people went with you to this place?	What time did you leave this place? <input type="checkbox"/> 7 : <input type="checkbox"/> 3 : <input type="checkbox"/> 1 <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM <input type="checkbox"/> Did not leave	What did you do at this place? Use the Activity List below. <i>01- Ate breakfast and got ready for work</i>
Place 2: Where did you go next? Provide place name and address/intersection: <i>Work - Arbor Law Firm</i> <i>990 Central Ave, Chicago, IL 60639</i>	<input type="checkbox"/> 7 : <input type="checkbox"/> 5 : <input type="checkbox"/> 4 <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	<i>Drove my car</i>	<i>0</i>	<input type="checkbox"/> 1 : <input type="checkbox"/> 2 : <input type="checkbox"/> 4 : <input type="checkbox"/> 5 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave	<i>03- Work</i>
Place 3: Where did you go next? Provide place name and address/intersection: <i>Gustoso's Pizza</i> <i>1800 Kerry Lane, Chicago, IL 60639</i>	<input type="checkbox"/> 1 : <input type="checkbox"/> 2 : <input type="checkbox"/> 5 : <input type="checkbox"/> 8 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	<i>Walked</i>	<i>2</i>	<input type="checkbox"/> 1 : <input type="checkbox"/> 4 : <input type="checkbox"/> 5 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave	<i>13- Buy and eat lunch</i>
Place 4: Where did you go next? Provide place name and address/intersection: <i>Work - Arbor Law Firm</i> <i>990 Central Ave, Chicago, IL 60639</i>	<input type="checkbox"/> 2 : <input type="checkbox"/> 0 : <input type="checkbox"/> 2 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	<i>Walked</i>	<i>2</i>	<input type="checkbox"/> 4 : <input type="checkbox"/> 5 : <input type="checkbox"/> 2 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave	<i>03- Work</i>
Place 5: Where did you go next? Provide place name and address/intersection: <i>Fairview Elementary</i> <i>7590 North Rd. Chicago IL 60639</i>	<input type="checkbox"/> 5 : <input type="checkbox"/> 0 : <input type="checkbox"/> 8 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	<i>Drove my car</i>	<i>0</i>	<input type="checkbox"/> 5 : <input type="checkbox"/> 2 : <input type="checkbox"/> 0 <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave	<i>06- Pick up daughter from school</i>
Place 6: Where did you go next? Provide place name and address/intersection:	<input type="checkbox"/> 5 : <input type="checkbox"/> 5 : <input type="checkbox"/> 4	<i>Drove my</i>		<input type="checkbox"/> 7 : <input type="checkbox"/> 3 : <input type="checkbox"/> 0	<i>01- Ate dinner and relaxed</i>



One Travel Day *Planned*



Next Travel Day Planned



Rationale for this work

What?

Explore the idea of latent demand through the lens of unmet activities and ultimately travel

Why?

A better definition and quantification of this idea can help to:

- better predict the impact of transportation investments,
- Anticipate response to social, technological, cultural and economic change
- help identify inequities,
- understand the consequences of these unmet demands and
- determine to what degree this unmet demand is a matter for transportation policy.

How?

Develop a theoretical framework & approach to data collection

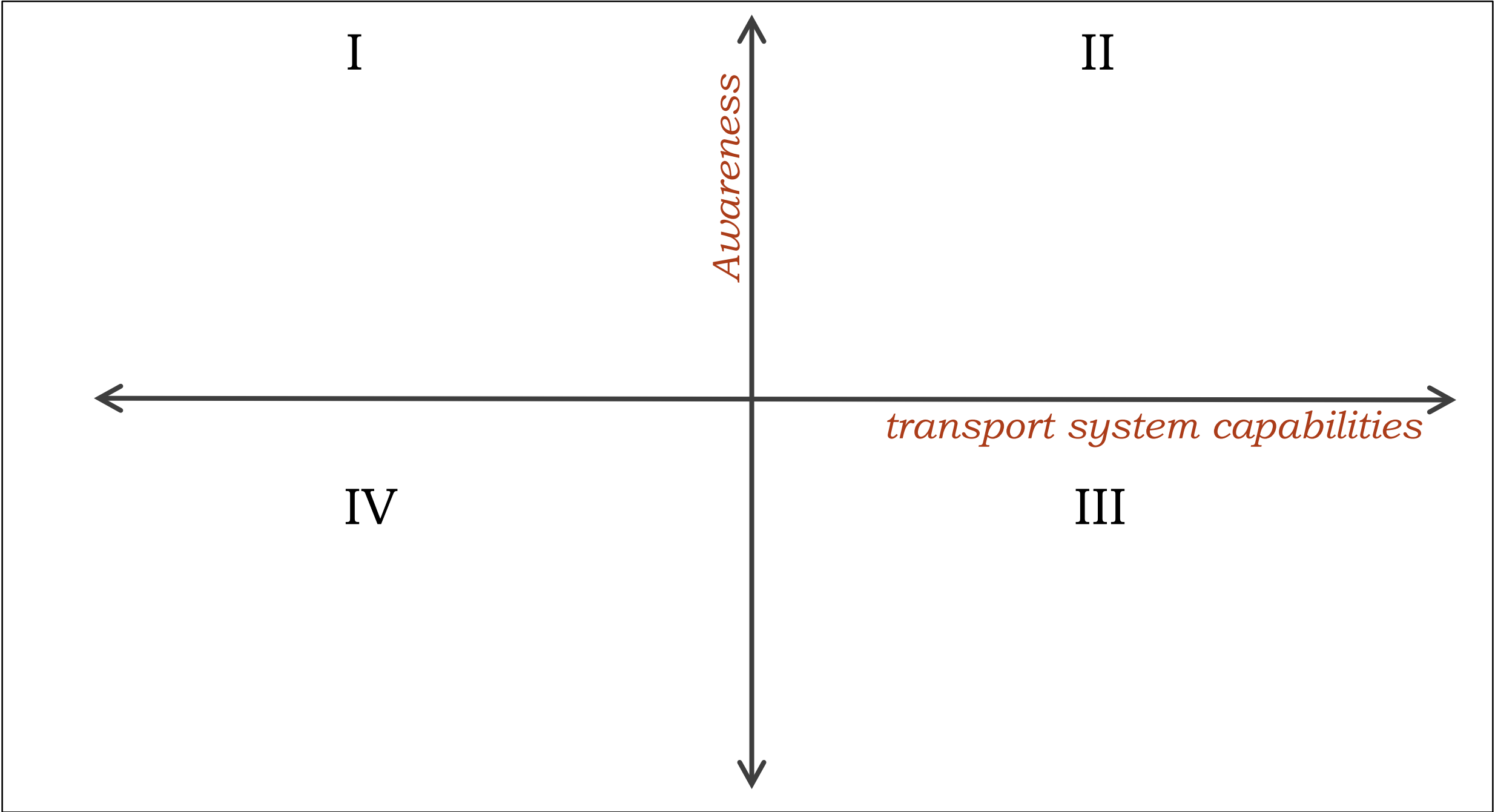
Other Definitions of Latent Demand

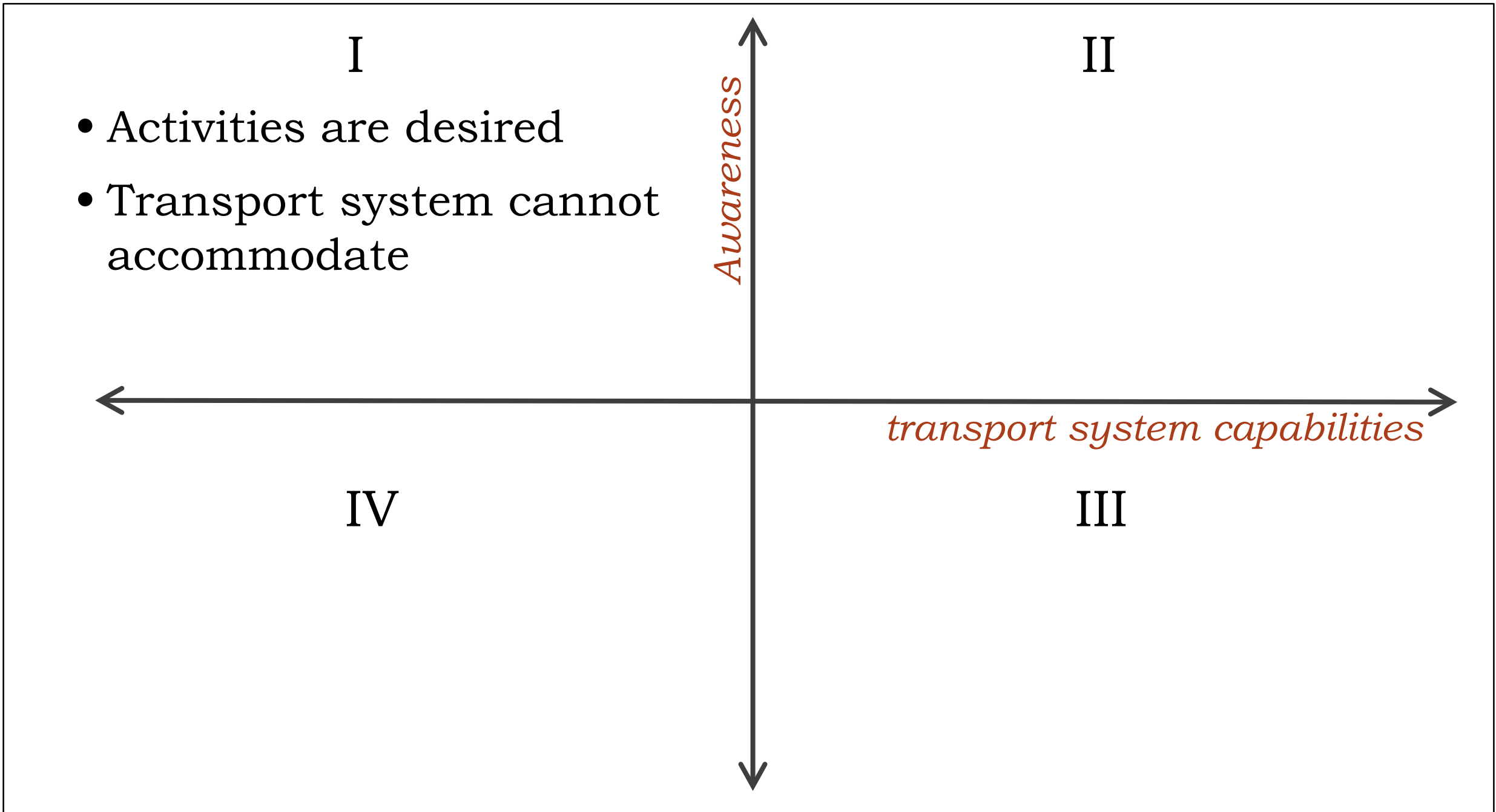
Induced demand, or latent demand, is the phenomenon that after supply increases, more of a good is consumed. –Wikipedia

Demand for a product or service that a consumer cannot satisfy because they do not have enough money, because the product or service is not available, or because they do not know that it is available. – Cambridge Dictionary

Latent demand is basically the desire for a product that a consumer is unable to satisfy because he is himself unable to point it out or doesn't realize what is missing until pointed out. –MBASkool

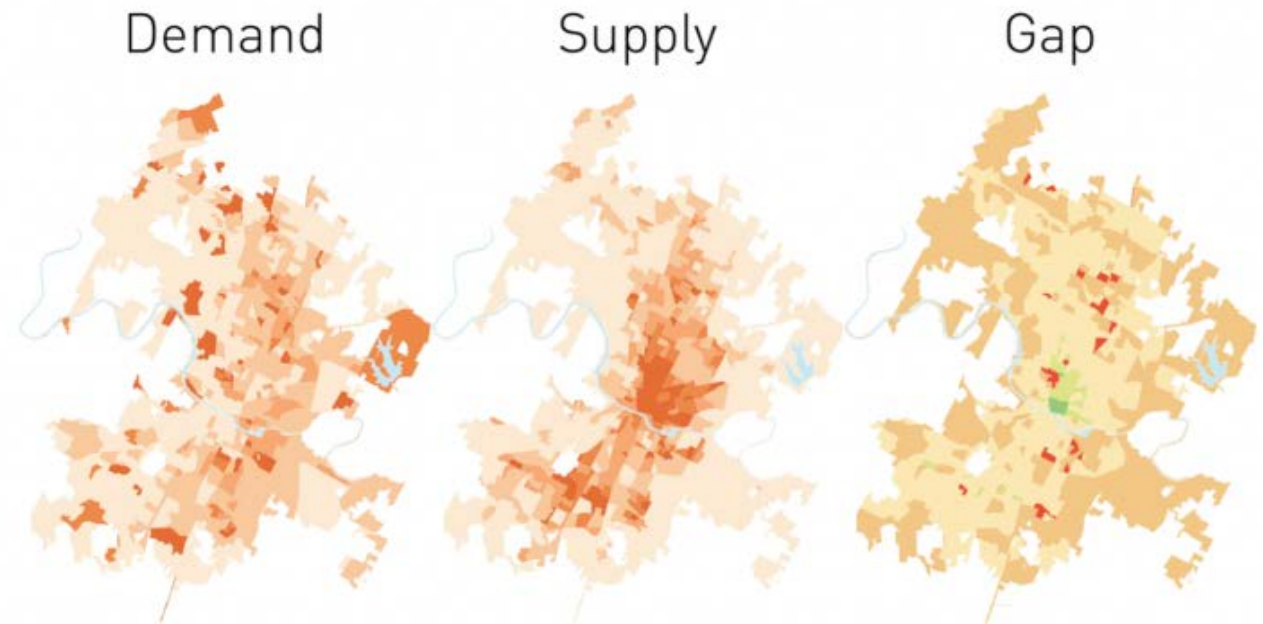
“In contrast to definitions of expressed demand based upon observable buying behavior, the concept of latent demand pertains to those with an interest in participation or “purchase”; who have not translated that interest into action.”
Richardson & Crompton





I. Examples

- Spatial or temporal gaps in transit service
- Travel times lead to time poverty
- No access to automobiles
- No internet access
- Food deserts
- No sidewalk infrastructure
- Lack of bicycle network connectivity



Junfeng Jiao and Aaron Nichols (2015) Identifying Transit Deserts in Texas Cities: The Gap Between Supply and Demand. University of Texas at Austin, Center for Sustainable Development, Working paper series

I

- Activities are desired
- Transport system cannot accommodate

II

- Activities are desired
- Transport system can accommodate
- Other barriers exist

Awareness

transport system capabilities

IV

III

II. Examples

- Poverty
- Activity schedule leads to time poverty (too busy)
- Scheduling conflicts
- Social exclusion
- Cultural barriers
- Lack of work experience or education
- Discrimination
- Housing costs limit choices



I

- Activities are desired
- Transport system cannot accommodate

II

- Activities are desired
- Transport system can accommodate
- Other barriers exist

Awareness

transport system capabilities

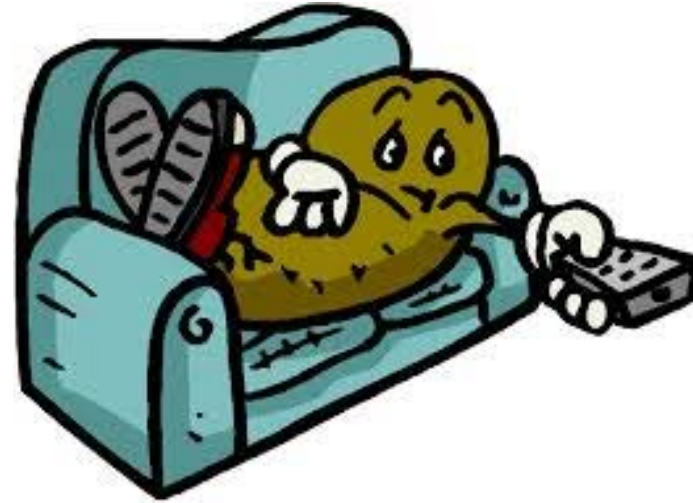
IV

III

- Activities are not desired
- Transport system can accommodate

III. Examples

- Mode exists but unaware of how to use it or where it goes
- Not (currently) motivated to engage in an activity
- Yet untried activity: Who knew I would love Stand Up Paddle Boarding?
- Unaware of new restaurant opening
- Surprise visit from a friend taking you to lunch



Newbie Guide

How to Use the
Bus & Tram

in France



*Talking
Suitcase*

I

- Activities are desired
- Transport system cannot accommodate

II

- Activities are desired
- Transport system can accommodate
- Other barriers exist

Awareness

transport system capabilities

IV

- Activities are not desired
- Transport system cannot accommodate

III

- Activities are not desired
- Transport system can accommodate

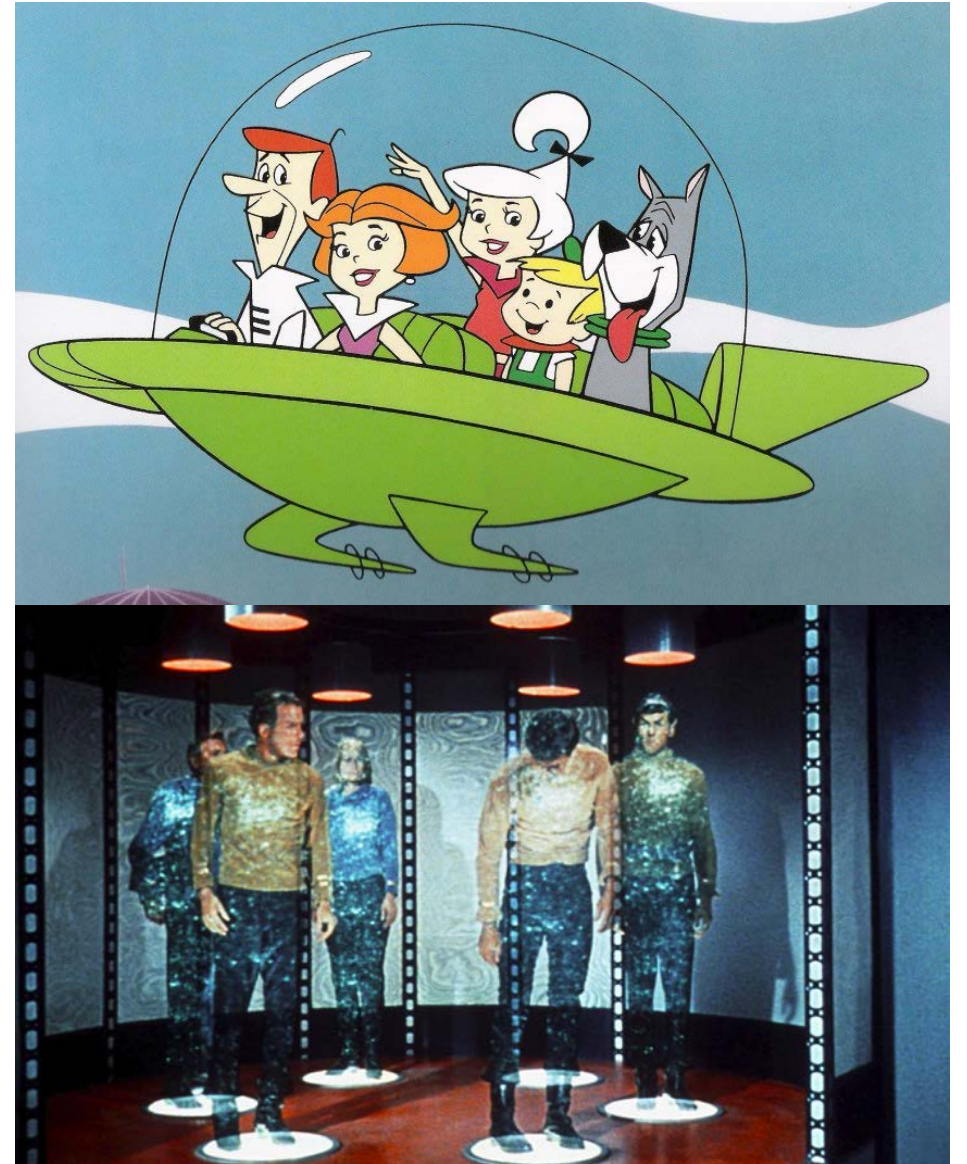
IV. Examples

Future modes:

- Driverless vehicles
- Teleportation
- Hovercraft
- SpaceX Hyperloop
- Drone delivery
- 3-D Printing
- Etc.

Previously (say in 1980):

- Online shopping
- Uber
- Smart phones
- Etc.



I

- Activities are desired
- Transport system cannot accommodate

II

- Activities are desired
- Transport system can accommodate
- Other barriers exist

Awareness

transport system capabilities

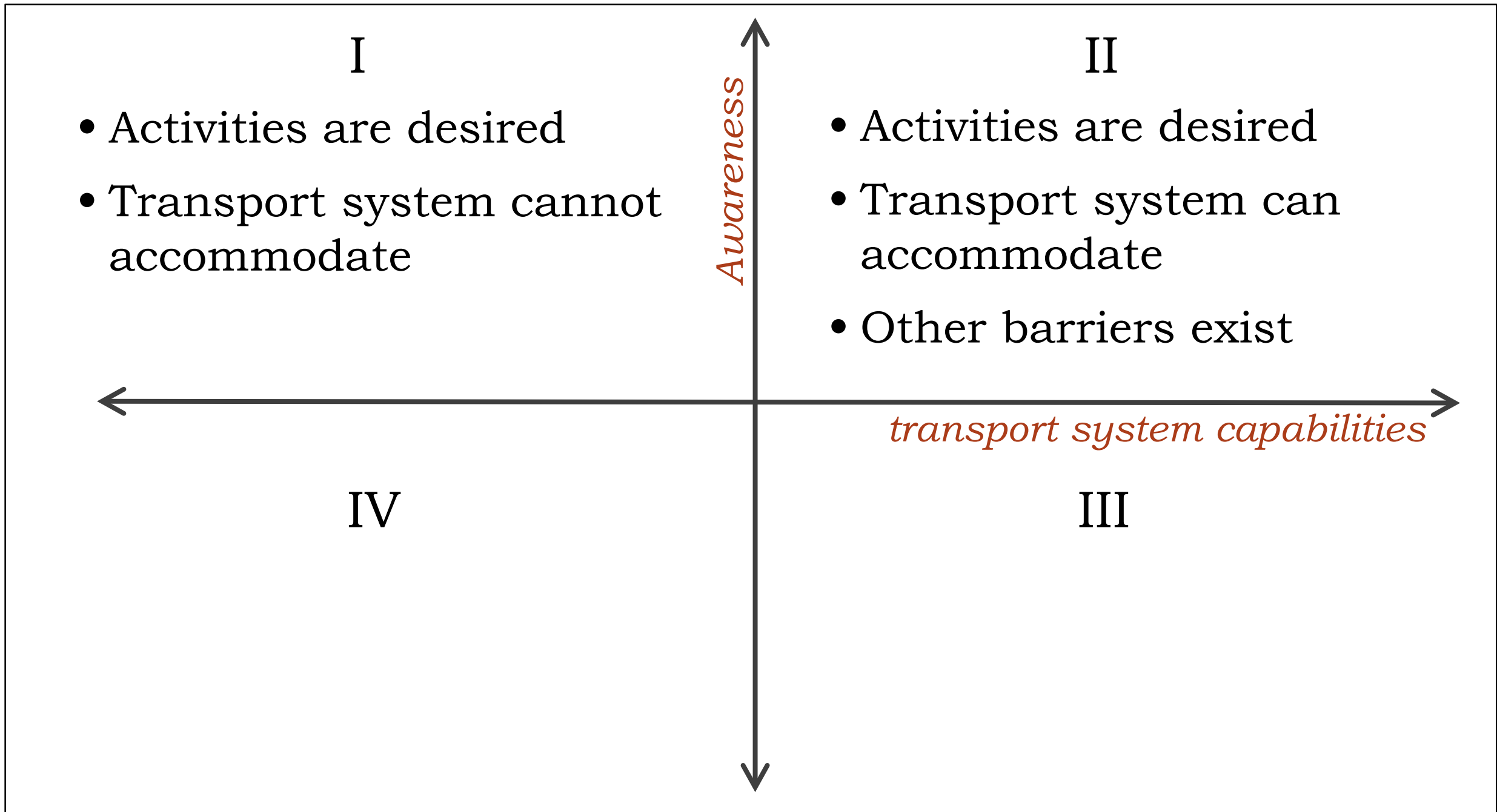
IV

- Activities are not desired
- Transport system cannot accommodate

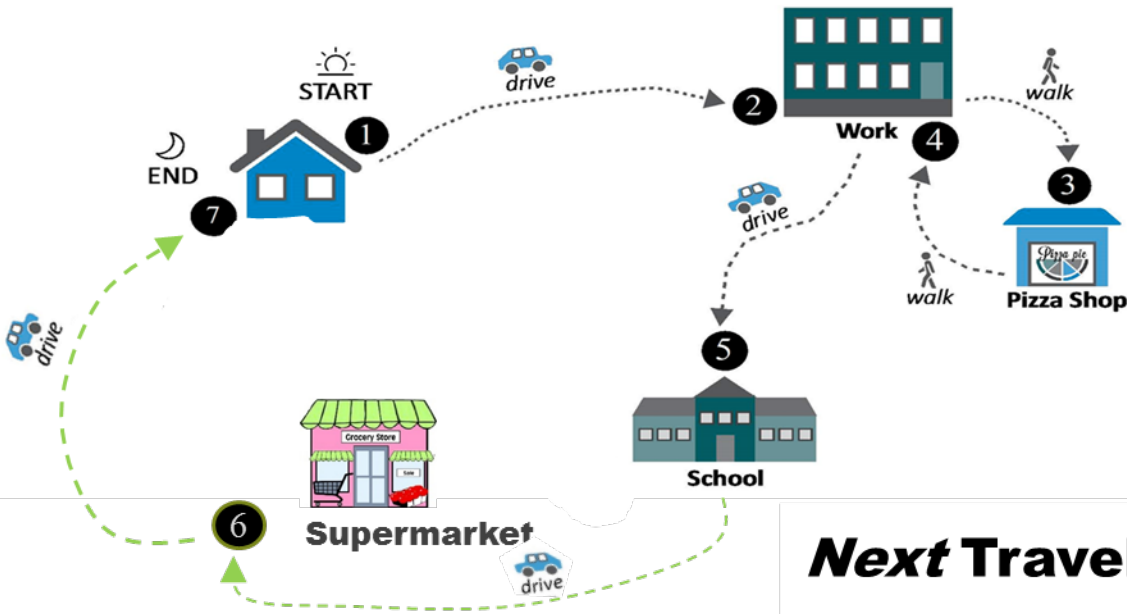
III

- Activities are not desired
- Transport system can accommodate

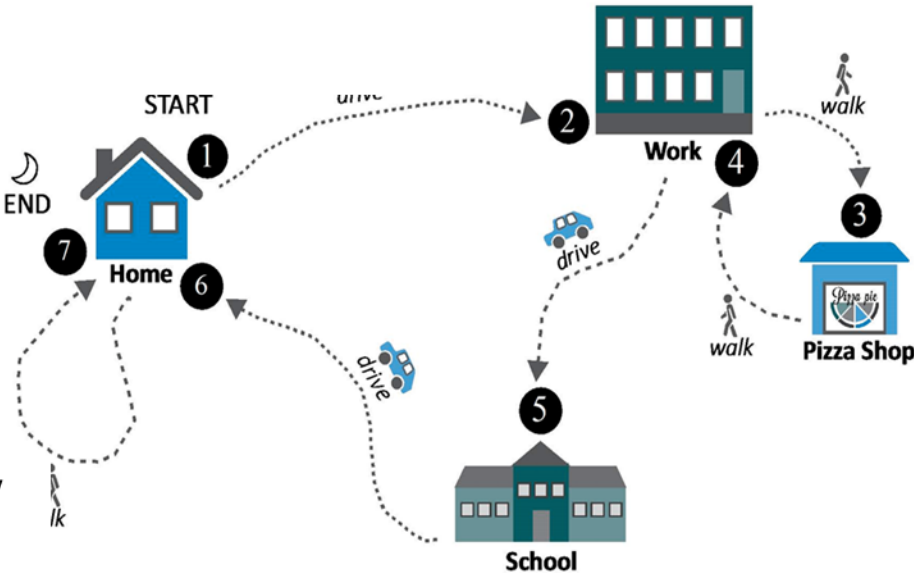
How might we capture these various
types of latent demand?



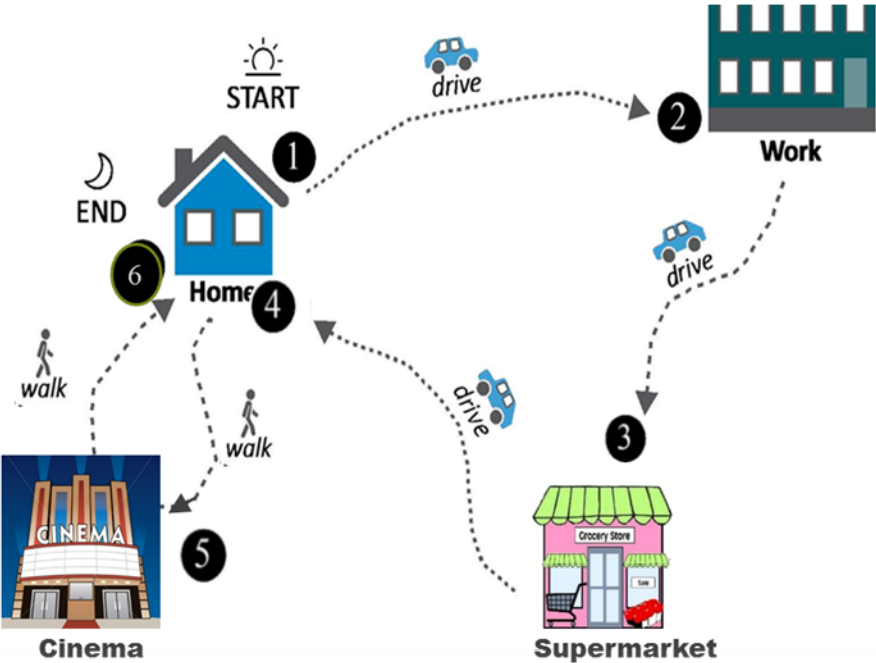
One Travel Day *Planned*



One Travel Day *Observed*



Next Travel Day Planned



Activity, travel, attitudes, & preferences (multi-day)

1 Where did you go?	2 How did you get there?	3 What did you do?
START HERE	What time did you arrive at this place?	How did you get to this place? (for example, walk, car, bus, train, etc.)
Place 1: Where were you at 4:00 AM on your assigned travel day? Provide place name and address/intersection: <i>Home</i>	What time did you leave this place? <input type="checkbox"/> 7:31 AM <input type="checkbox"/> PM <input type="checkbox"/> Did not leave	What time did you arrive at this place? <input type="checkbox"/> 7:31 AM <input type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 2: Where did you go next? Provide place name and address/intersection: <i>Work — Arbor Law Firm 990 Central Ave, Chicago, IL 60639</i>	How did you get to this place? <i>Drove my car</i>	What time did you leave this place? <input type="checkbox"/> 12:45 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 3: Where did you go next? Provide place name and address/intersection: <i>Gustoso's Pizza 1800 Kerry Lane, Chicago, IL 60639</i>	How did you get to this place? <i>Walked</i>	What time did you leave this place? <input type="checkbox"/> 1:45 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 4: Where did you go next? Provide place name and address/intersection: <i>Work — Arbor Law Firm 990 Central Ave, Chicago, IL 60639</i>	How did you get to this place? <i>Walked</i>	What time did you leave this place? <input type="checkbox"/> 4:52 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 5: Where did you go next? Provide place name and address/intersection: <i>Fairview Elementary 7590 North Rd, Chicago IL 60639</i>	How did you get to this place? <i>Drove my car</i>	What time did you leave this place? <input type="checkbox"/> 5:20 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 6: Where did you go next? Provide place name and address/intersection:	How did you get to this place?	What time did you leave this place?



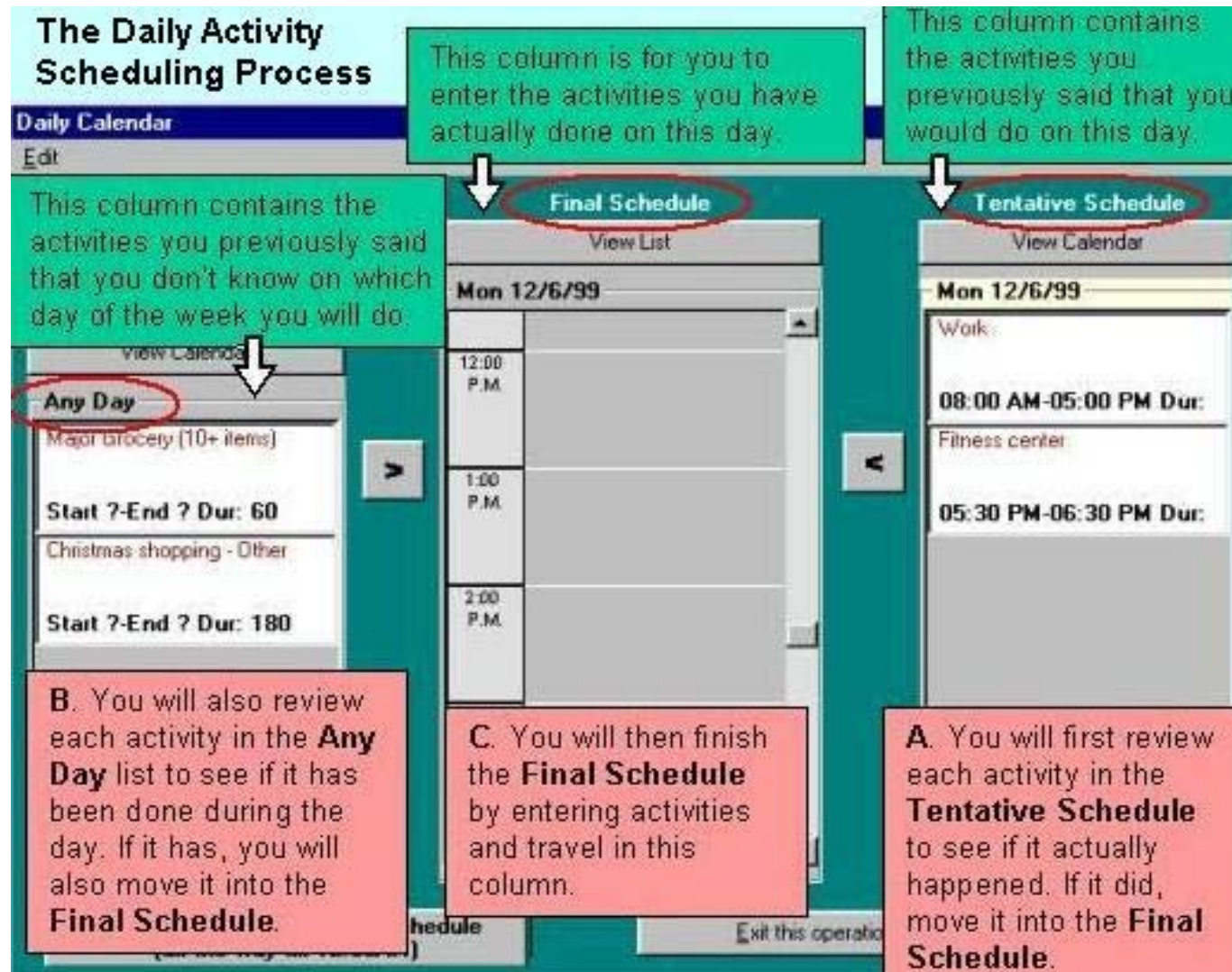
Activity, travel, attitudes, & satisfaction (multi-day)

1 Where did you go?	2 How did you get there?			3 What did you do?
START HERE	What time did you arrive at this place?	How did you get to this place? (for example, walk, car, bus, train, etc.)	How many people went with you to this place?	What time did you leave this place?
Place 1: Where were you at 4:00 AM on your assigned travel day? Provide place name and address/intersection: <i>Home</i>				<input type="checkbox"/> 7:31 AM <input type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 2: Where did you go next? Provide place name and address/intersection: <i>Work — Arbor Law Firm 990 Central Ave, Chicago, IL 60639</i>	<input checked="" type="checkbox"/> 7:54 AM <input type="checkbox"/> PM	<i>Drove my car</i>	<i>0</i>	<input type="checkbox"/> 1:45 PM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 3: Where did you go next? Provide place name and address/intersection: <i>Gustoso's Pizza 1800 Kerry Lane, Chicago, IL 60639</i>	<input type="checkbox"/> 1:58 AM <input checked="" type="checkbox"/> PM	<i>Walked</i>	<i>2</i>	<input type="checkbox"/> 1:45 PM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 4: Where did you go next? Provide place name and address/intersection: <i>Work — Arbor Law Firm 990 Central Ave, Chicago, IL 60639</i>	<input type="checkbox"/> 2:02 AM <input checked="" type="checkbox"/> PM	<i>Walked</i>	<i>2</i>	<input type="checkbox"/> 4:52 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 5: Where did you go next? Provide place name and address/intersection: <i>Fairview Elementary 7590 North Rd, Chicago IL 60639</i>	<input type="checkbox"/> 5:08 AM <input checked="" type="checkbox"/> PM	<i>Drove my car</i>	<i>0</i>	<input type="checkbox"/> 5:20 AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> Did not leave
Place 6: Where did you go next? Provide place name and address/intersection:		<i>Drove my</i>		<input type="checkbox"/> 7:30 AM <input type="checkbox"/> PM <input type="checkbox"/> Did not leave



But not enough for unmade trips & unrealized activities





Activity Scheduling Process

Work in the early 2000s

Computer aided survey

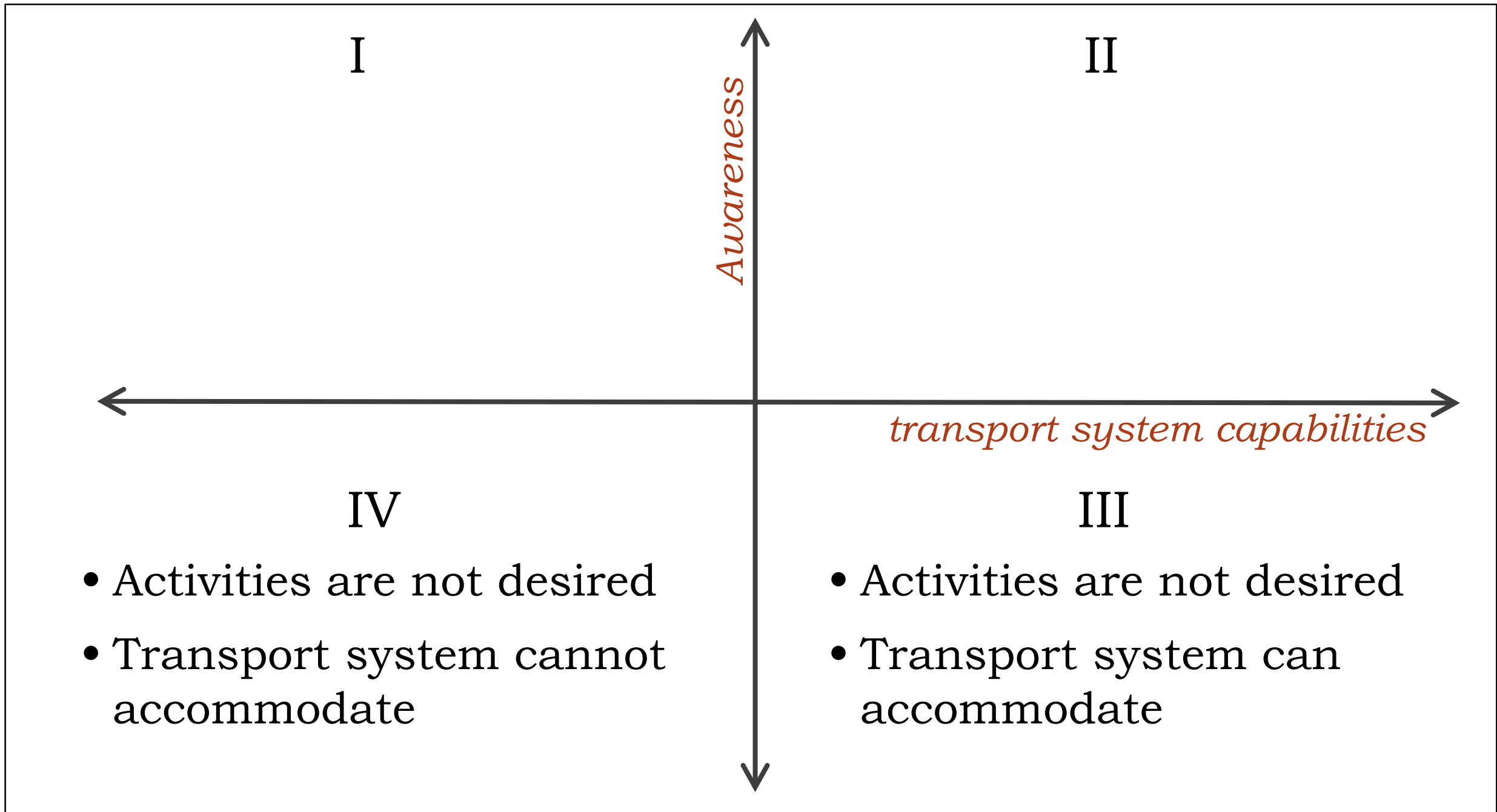
Collect information on the planning process:

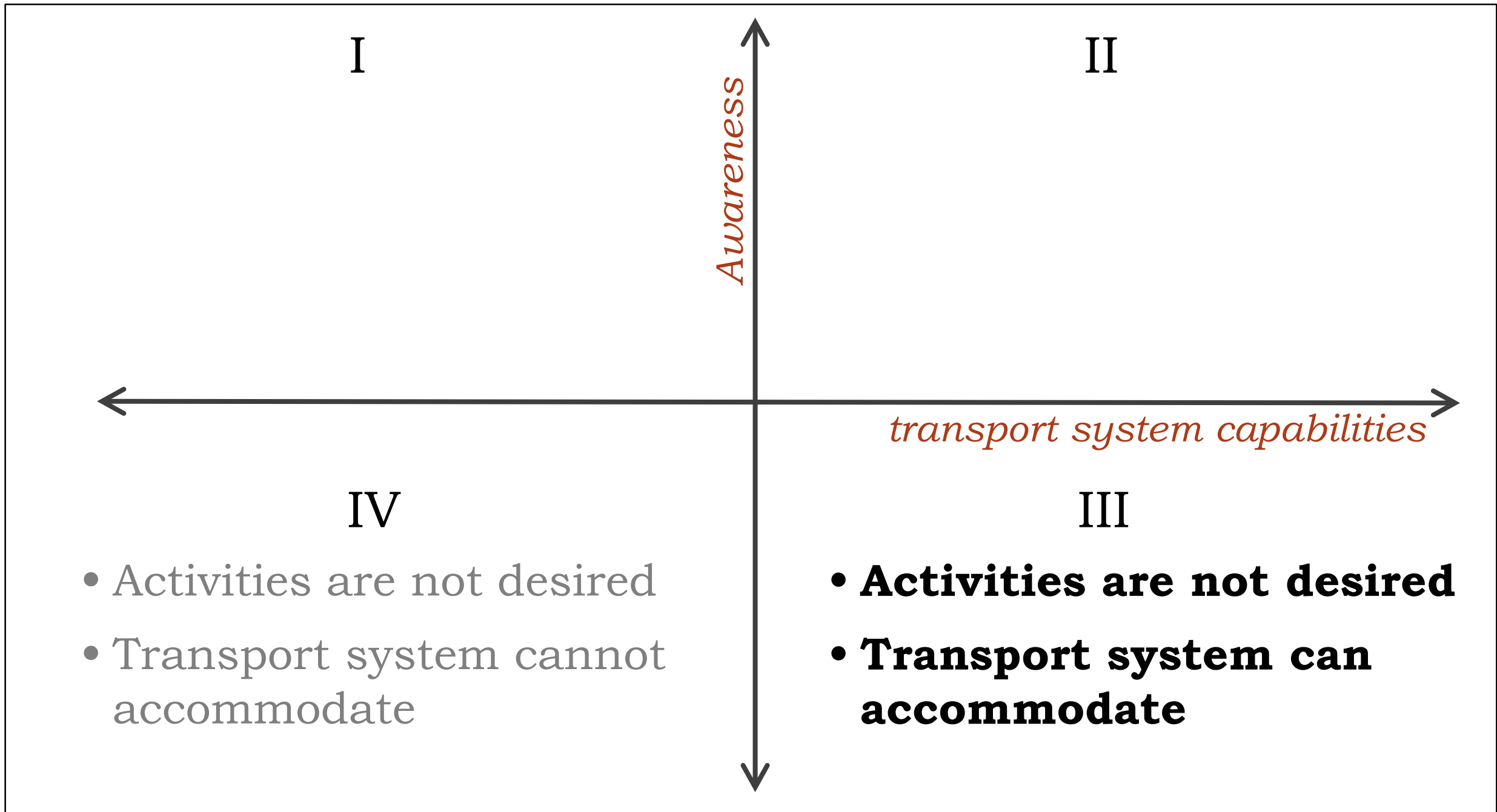
- What you plan to do?
- When you plan to do it?
- What you actually did?
- How did it work out for you?

Large respondent burden

Could be revisited with smart phone technology

McNally, MG and Lee, MS (2002). *Putting Behavior in Household Travel Behavior Data: An Interactive GIS-based Survey Via the Internet*, Final Report to the University of California Transportation Center, Berkeley, CA.





Behavioral change

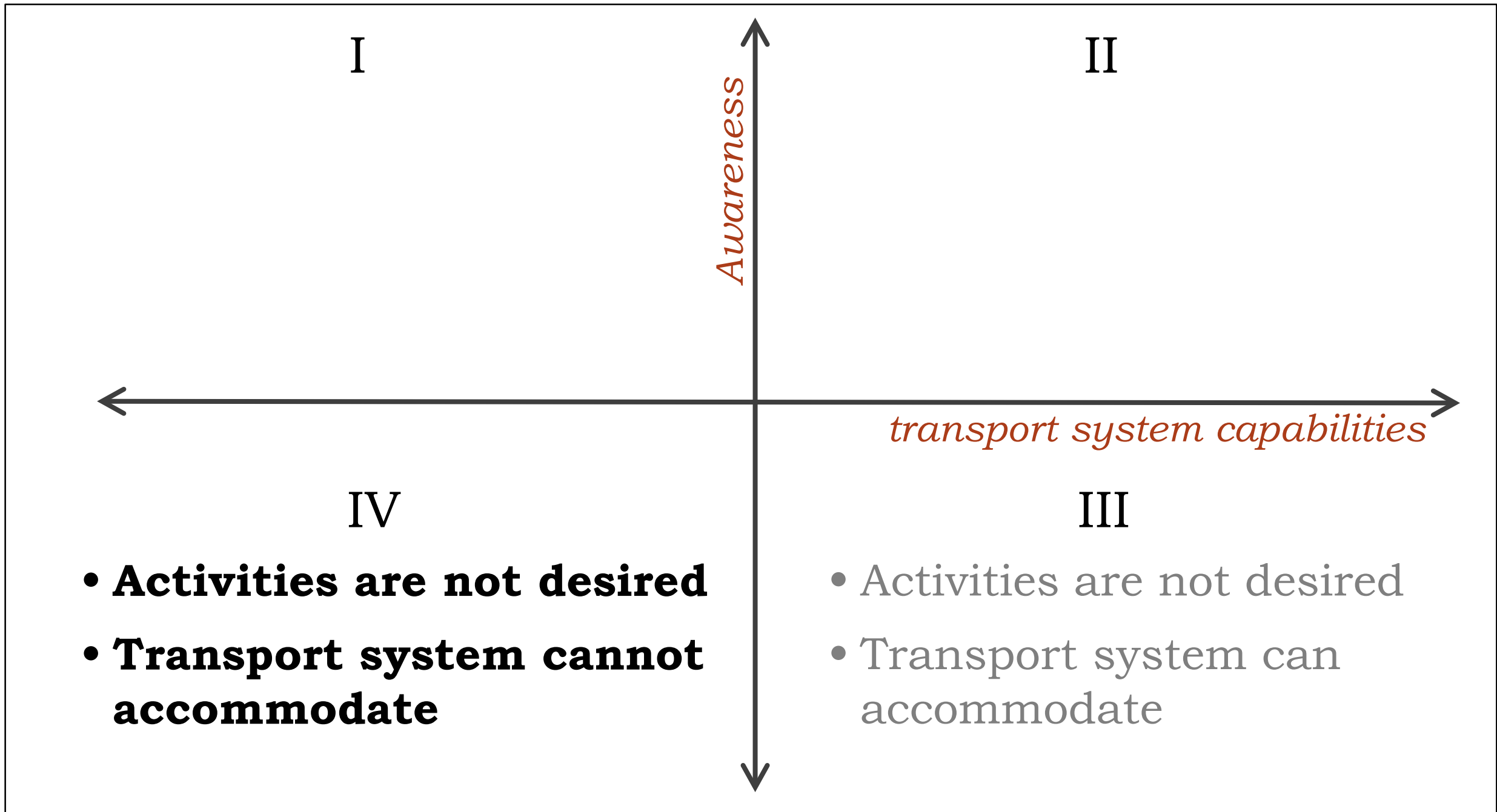
If the public is not aware of existing options or not motivated to use them, programs can work to address the gaps

Drawing upon research in health disciplines:

- Education/Awareness
- Information
- Motivation
- Support

Public campaigns to reduce driving, learn how to use transit, ride a bike, encourage walking.





Stated Preference Surveys

Option A

Cost: \$2.50

Travel time: 30 minutes

Share ride with others



Option B

Cost: \$12

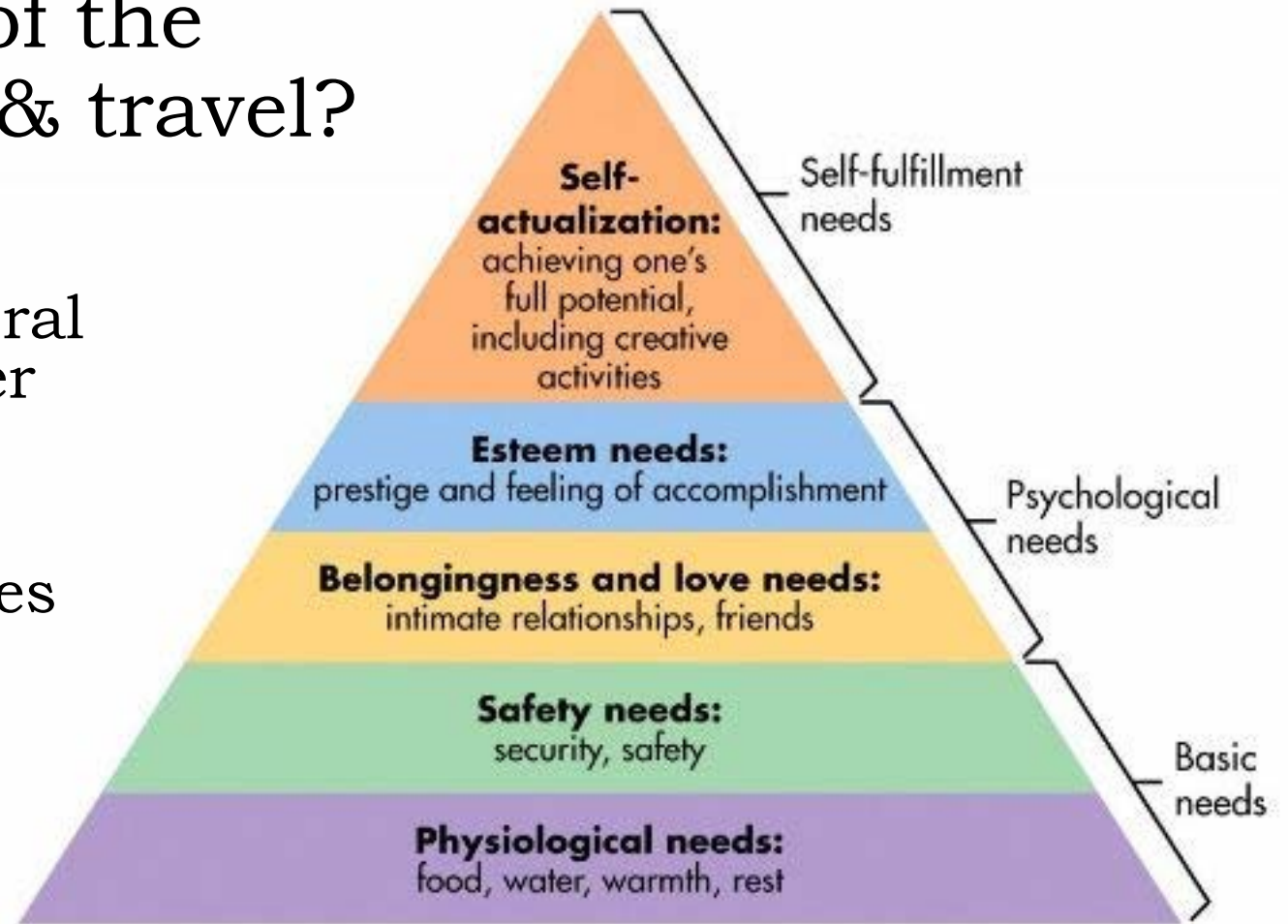
Travel time: 20 minutes

Have vehicle to yourself



What are the drivers of the demand for activities & travel?

- What motivates us?
- Psychology & other behavioral disciplines have a lot to offer
- Might be important to understand how we might respond to new opportunities in the future
- Marketing discipline has made use of this research
- They induce demand for products
- What can we learn here?



Maslow, A. H. (1943). A Theory of Human Motivation. *Psychological Review*, 50(4), 370-96.

Hypothetical

A vertical arrow pointing upwards, indicating a progression from the bottom to the top of the funnel.

Constraints

A vertical arrow pointing downwards, indicating a progression from the top to the bottom of the funnel.

6. Unimagined Activities

5. Dreams, Desires Possibilities

4. Aspirations & Intentions

3. Tentative Planned
Activities & Travel

2. Scheduled Activity &
Travel Agenda

1. Realized Activity &
Travel Pattern

Conclusions

Our current theories, data collection, and methods are inadequate.

We need a more theoretically-sound definition of demand.

Theoretical exploration of the origins of activity demand from multiple disciplines could enrich and improve our efforts to plan for the future.

Understand unmet needs and how transportation policies, other programs and innovations may address demand.



QUESTIONS?

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